Calculus Warm Up #10-2

use L'Hôpital's Rule to evaluate (k is a constant $\neq 0$)

1. $\lim_{x \to k} \dfrac{\sqrt[3]{x} - \sqrt[3]{k}}{x - k}$

2. $\lim_{x \to 1^+} \left(\dfrac{2}{\ln x} - \dfrac{2}{x - 1} \right)$

HW Questions:

In Exercises 1–4, evaluate the limit (a) using techniques from Chapters 2 and 4 and (b) using L'Hôpital's Rule.

1. $\lim_{x \to 3} \dfrac{2(x - 3)}{x^2 - 9}$

3. $\lim_{x \to \infty} \dfrac{5x^2 - 3x + 1}{3x^2 - 5}$

In Exercises 5–30, evaluate each limit, using L'Hôpital's Rule if necessary.

5. $\lim_{x \to 2} \dfrac{x^2 - x - 2}{x - 2}$

7. $\lim_{x \to 0} \dfrac{\sqrt{4 - x^2} - 2}{x}$

9. $\lim_{x \to 0} \dfrac{e^x - (1 - x)}{x}$

In Exercises 5–30, evaluate each limit, using L'Hôpital's Rule if necessary.

11. $\lim_{x\to 0^+} \dfrac{e^x - (1+x)}{x^n}, \quad n = 1, 2, 3, \ldots$

if $n=1 \to 0$, $n=2 \to \frac{1}{2}$, $n=3 \to$

$n=4 \quad \lim_{x\to 0} \dfrac{e^x-(1+x)}{x^4}$

$\dfrac{e^x-1}{4x^3} \to \dfrac{e^x}{12x^2}$

$\dfrac{1}{0} \to \infty$

for $n \geq 3$

∞

13. $\lim_{x\to\infty} \dfrac{\ln x}{x}$

15. $\lim_{x\to\infty} \dfrac{3x^2 - 2x + 1}{2x^2 + 3}$

17. $\lim_{x\to\infty} \dfrac{x^2 + 2x + 3}{x - 1}$

19. $\lim_{x\to 0^+} (x^2 \ln x)$ $\to$ $\lim_{x\to 0^+} \dfrac{\ln x}{x^{-2}}$

$\dfrac{\frac{1}{x} \cdot x^3}{-2x^{-3}}$

21. $\lim_{x\to 2} \left(\dfrac{8}{x^2-4} - \dfrac{x}{x-2}\right)$

$\lim_{x\to 0^+} \left(-\dfrac{x^2}{2}\right)$

0

23. $\lim_{x\to\infty} \frac{x}{\sqrt{x^2+1}}$

25. $\lim_{x\to 0^+} x^{1/x}$

27. $\lim_{x\to\infty} x^{1/x}$

29. $\lim_{x\to\infty} (1+x)^{1/x}$

$\frac{\infty}{\infty}$

$\lim_{x\to\infty} \frac{1}{\frac{1}{2}(x^2+1)^{-1/2}(2x)}$

$\lim_{x\to\infty} \frac{1}{\frac{x}{\sqrt{x^2+1}}}$

$\lim_{x\to\infty} \frac{\sqrt{x^2+1}}{x}$

$\frac{\infty}{\infty}$

$\frac{\infty}{\infty}$

let $\sqrt{x^2} = x$

$\lim_{x\to\infty} \frac{\frac{x}{x}}{\sqrt{\frac{x^2}{x^2}+\frac{1}{x}}}$

$\lim_{x\to\infty} \frac{1}{\sqrt{1+\frac{1}{x}}}$

23. $\lim_{x\to\infty} \frac{x}{\sqrt{x^2+1}}$

25. $\lim_{x\to 0^+} x^{1/x}$

27. $\lim_{x\to\infty} x^{1/x}$

29. $\lim_{x\to\infty} (1+x)^{1/x}$

$0^{\frac{1}{0}} = 0^{\infty} = 0$

$\infty^{\frac{1}{\infty}} = \infty^{0}$

$\lim_{x\to\infty} \frac{1}{x}\ln x = \frac{\infty}{\infty}$

$\lim_{x\to\infty} = \frac{1}{x}$

$\to 0$

$\frac{1}{\infty}$

$\ln y = 0$

$e^0 = y$

$= 1$

Summary:

Indeterminate Forms

$0^0 \quad \infty^0 \quad 1^\infty$	Use Natural Logarithms
$\frac{0}{0} \quad \frac{\infty}{\infty}$	Use L'Hôpital's Rule
$\infty - \infty$	Change the form by adding or subtracting
$0 \cdot \infty$	Change the form to get $\frac{0}{0}$ or $\frac{\infty}{\infty}$ and then use L'Hôpital's Rule

Determinate Forms

$\infty + \infty = \infty$ $0^\infty = 0$	$-\infty - \infty = -\infty$ $\frac{1}{0^\infty} \leftarrow 0^{-\infty} = \infty$
$\frac{0}{L} \quad \frac{L}{\pm\infty} \quad \frac{0}{\pm\infty}$	Limit is Zero
$\frac{L}{0} \quad \frac{\pm\infty}{L} \quad \frac{\pm\infty}{0}$	Limit is Infinite

Classwork: Rev. #1 (Green)

Next test is Monday, Nov. 13

Covers: 7.2, 7.5 & 7.8

and past topics:

evaluate limits, continuity, concavity, instantaneous rate of change, implicit differentiation

HW: p. 415

13 - 37 odd, 85 - 91 odd